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NASA TECH BRIEF

Laser Method for Finding Axis of Rotation

The problem:

To determine remotely the axis of rotation of a moving body.

The solution:

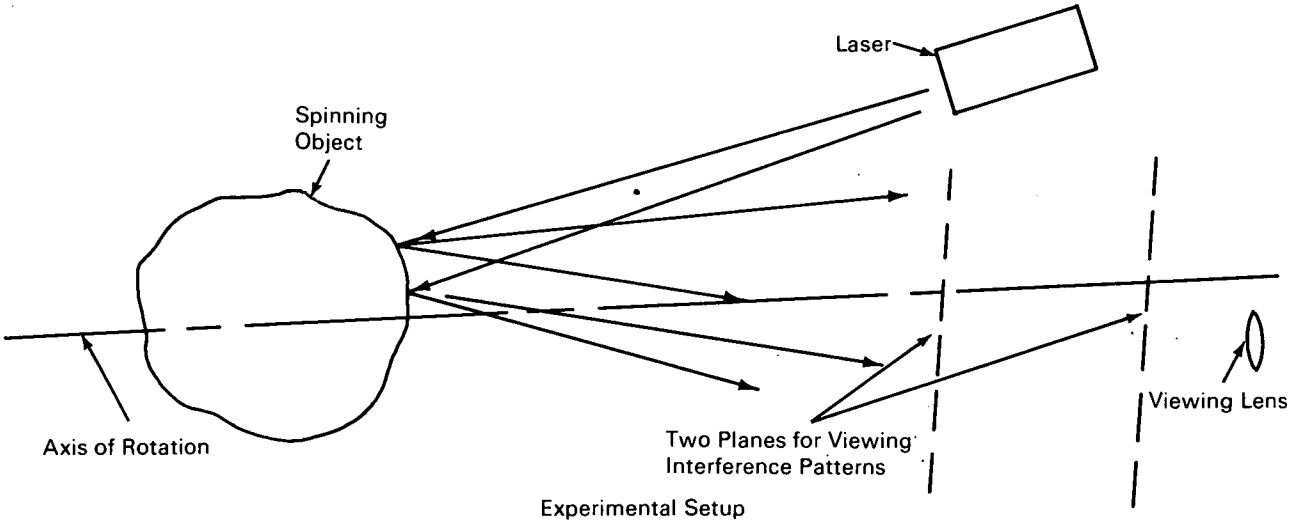
Illuminate the rotating surface with a laser beam and examine the interference patterns resulting from diffused reflections to determine the position of the axis and the direction of motion.

How it's done:

A laser beam is directed toward a diffuse reflecting surface on the rotating object. Light is reflected from the surface as random phase waves which overlap in the region of space in front of the surface and form random ("sparkle") interference patterns that rotate as the object rotates. The interference patterns can be viewed through a lens or recorded on film as circular streaking patterns. With the aid of a viewing lens, the interference patterns in two different planes can be examined.

The interference pattern at any distance from the surface rotates with the surface. For rotation angles greater than a few degrees, the circular streaking is clearly visible. Since all streaks are concentric with the axis, the axis position is that point in the interference pattern where the streaking reduces to zero. If two interference planes at different distances from the surface are examined, the position of the rotational axis can be determined in each plane within an error equal to the width of one bright point in the interference pattern. The accuracy of the axial direction measurement is limited (by diffraction) to an angular error approximately equal to the wavelength divided by the illuminated diameter of the beam at the reflecting surface. A value of 10^{-4} radian for a beam diameter of 10 millimeters can be obtained.

(continued overleaf)



Experimental Setup

Note:

The following documentation may be obtained from:

National Technical Information Service
Springfield, Virginia 22151
Single document price $3.00
(or microfiche $0.65)

Reference:
NASA-CR-985 (N68-14070), Study of Vibration Measurement by Laser Methods

Patent status:

No patent action is contemplated by NASA.

Source: G. A. Massey
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